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IS 4794-1 (1968): Push-button switches, Part 1: General requirements and tests [LITD 3: Electromechanical Components and Mechanical Structures for Electronic Equipment]



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(Reaffirmed 2002)

Indian Standard

SPECIFICATION FOR PUSH-BUTTON SWITCHES

PART I GENERAL REQUIREMENTS AND TESTS

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**BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002**

Indian Standard

**SPECIFICATION FOR
PUSH-BUTTON SWITCHES**

PART I GENERAL REQUIREMENTS AND TESTS

Electromechanical Components for Electronic Equipment
Sectional Committee, ETDC 37

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Indian Standard
**SPECIFICATION FOR
PUSH-BUTTON SWITCHES**

PART I GENERAL REQUIREMENTS AND TESTS

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 7 October 1968, after the draft finalized by the Electromechanical Components for Electronic Equipment Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard deals with the general requirements and tests for push-button switches for electronic and telecommunication equipment. It is not intended to cover microswitches and other specialized switches in this standard.

0.3 These switches may comprise a button actuating a switch connected to a supply network.

0.4 The object of this standard is to establish uniform requirements for:

- a) the electrical, climatic and mechanical properties as well as safety aspects;
- b) test methods;
- c) interchangeability and compatibility; and
- d) classification of push-button switches into groups according to their ability to withstand extremes of temperature and humidity.

0.5 This standard is one of a series of Indian Standards on electro-mechanical components for electronic equipment.

0.6 Assistance has been derived from IEC document 48C (Central Office) 9 'Draft push-button switches; general requirements and measuring methods' issued by the International Electrotechnical Commission.

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0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS: 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part I) relates to push-button switches having a rated voltage not exceeding 500 V dc or ac and rated current not exceeding 25 A for use in electronic and telecommunication equipment.

1.2 This standard does not cover electromagnetically operated switches.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Push-Button Switch

2.1.1 Single-Button Switch — A switch consisting of one cell and its associated mountings, actuated by a push-button or rod, which requires pushing for each action. The action may be momentary with spring (mechanical) return.

2.1.2 Multi-Button Switch — A frame assembly containing two or more cells and their associated mountings. The cells may or may not be inter-locked (for example, one button returns when another is pressed). The frames may be stacked horizontally and/or vertically.

2.1.3 Piano Key Button Switch — A switch, the buttons of which are assembled and actuated in the manner of piano keys.

2.1.4 Double Pressure Button Switch — A switch, the buttons of which engage at the first pressure and still remains engaged (locked) after the removal of the applied force. The button is disengaged when a second pressure is applied.

2.2 Cell — Assembly formed by a push-button, the mechanical system and the electrical contacts.

2.3 Push-Button/Button — That part of the switch upon which external pressure is applied to operate the switch.

NOTE — The word 'push-button' may be accompanied by a qualifying adjective 'independent' which, in fact, expresses a property of the mechanical system.

*Rules for rounding off numerical values (revised).

2.3.1 Illuminated Button — A button which has associated with it a lamp which can give a visual indication by illumination. The lamp circuitry shall be related to the button action.

2.3.2 Locking Button — A button which remains in the operated position even after the removal of the applied pressure.

2.3.3 Non-locking Button — A button which remains in the operated position only while the pressure is applied. Removal of this pressure restores the button to its normal position.

2.3.4 Interdependent Button — Two or more buttons, such that the operation of one of them causes the tripping of all the others. The same switch may comprise several distinct groups of interdependent buttons.

2.3.5 Independent Button — A button, which when subjected to normal manual action has no effect on other buttons; similarly the other buttons, when actuated, have no effect on the independent button. Includes locking and non-locking types.

2.3.6 Cancelling Button — A button in a multi-button switch, which when operated restores to normal, a predetermined number of previously operated buttons.

2.3.7 Push-to-Lock Button — A button which makes it possible to lock in either the 'on' position or the 'off' position a given number of buttons.

2.4 Mechanical System — A system ensuring the transmission of the pressure on the push-buttons to the movable contacts.

Note — The transmission of this movement may be accompanied in some cases by one or more of the following operations:

- a) Change of direction of movement,
- b) Change of movement initiated by the push-button into a rotating movement of the part carrying the moveable contacts, and
- c) Locking of the button and of the mechanism connected with it (double pressure button).

2.5 Mechanical Features

2.5.1 Operation — The movement of button of the full extent of its permissible travel when a pressure is first applied and then subsequently removed.

2.5.2 Positions — The number of positions of rest (including non-locking) that the button may occupy.

2.5.3 Normal Position — The position assumed by the push-button when no pressure is exerted upon it.

2.5.4 Operated (Actuated) Position — The position assumed by the push button when a pressure resulting in its displacement is exerted upon it.

2.5.5 Accumulative Latching — An action such that any number of buttons will remain operated until a separate cancelling button is operated.

2.5.6 Contact Actions — The nature of operations executed by the contacts. The contact actions normally to be envisaged are:

- a) *Make* — Contacts close with button in operated position,
- b) *Break* — Contacts open with button in operated position,
- c) *Break before make* — One contact open completely before the next contact is made,
- d) *Make before break* — One contact maintained until after the next contact is made, and
- e) *Changeover* — A contact unit having a contact member common to two contact circuits one of which is open and the other closed when the relay is not energized. It may have break before make or make before break actions.

2.5.7 Blocking Action — A system preventing the operation of more than one button at a time.

2.6 Rated Voltage (U_R) — The maximum voltage which the contacts are capable of interrupting for the specified number of operations at the switch breaking capacity.

2.7 Rated Current — The maximum current which the contacts are capable of interrupting for the specified number of operations at the switch breaking capacity.

2.8 Switch Breaking Capacity — is the 'volt-ampere' capacity which the contacts are capable of interrupting. The 'volt-ampere' capacity is the product of the voltage across the contacts when open and the current through the contacts when closed.

2.9 Type — Components having similar design features (exclusive of mounting accessories, provided they have no significant effect on the test results) and falling within the manufacturers' usual range of ratings for such a design.

2.10 Type Tests — Tests carried out to prove conformity with the requirements of this standard. These are intended to prove the general qualities and design of a given type of push-button switch.

2.11 Acceptance Tests — Tests carried out on samples selected from a lot for purpose of verifying the acceptability of the lot.

2.11.1 Lot — All push-button switches of the same type, category and rating, manufactured by the same factory during the same period, using the same process and materials.

2.12 Routine Tests — Tests carried out on each push-button switch to check the requirements which are likely to vary during production.

3. CATEGORIES

3.1 The push-button switches shall be divided into the following categories based on their ability to withstand the climatic severities listed below:

<i>Climatic Test</i> (see IS : 589-1961*)	<i>Severity</i>		
	Category 1	Category 2	Category 3
Dry heat	+100°C	+85°C	+70°C
Cold	— 55°C	—40°C	—10°C
Damp heat (long term)	56 days	56 days	21 days
Damp heat (accelerated)	6 cycles	6 cycles	2 cycles
Rapid change of temperature	+100°C to — 55°C	+85°C to —40°C	Not applicable
Low air pressure	44 mbar	300 mbar	600 mbar

NOTE — In case of special requirements where the above categories cannot be applied, different combinations of climatic severities may be agreed to between the purchaser and the supplier, provided that the degrees of severity are chosen from those specified in IS : 589-1961*.

4. ELECTRICAL RATINGS

4.1 The relevant individual specification of the switch shall specify:

- a) rated voltage.
- b) rated current,
- c) switch breaking capacity, and
- d) circuit conditions and associated combinations of voltage and current.

5. MATERIALS AND WORKMANSHIP

5.1 Materials — The push-button switches shall be constructed from suitable materials which shall be free from flaws and other defects and shall as far as practicable, conform to the relevant Indian Standard, if any.

*BASIC climatic and mechanical durability tests for electronic components (revised).

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When dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided. The use of dissimilar metals in contact, which tends towards active electrolytic corrosion (particularly brass, copper and steel used in contact with aluminium or aluminium alloy) is not acceptable. However, metal plating or metal spraying of dissimilar base metals to provide similar or suitable abutting surface is permitted.

5.2 Workmanship — All parts of the switch shall be manufactured in a thoroughly workmanlike manner, and in accordance with the good engineering practice.

6. MARKING

6.1 Each push-button switch shall be clearly marked with the following information, whenever relevant, in the order given below:

- a) Manufacturer's name and/or trade-mark;
- b) Manufacturer's type number or code number;
- c) Manufacturer's batch number;
- d) Any additional requirement if required by the purchaser or any other marking agreed by the manufacturer and the purchaser; and
- e) Country of manufacture.

6.1.1 The following information shall be made available, when called for, in addition to those specified in 6.1:

- a) Electrical relating as given in 4.1,
- b) Category,
- c) Contact configuration, and
- d) Any other details.

6.1.2 The manufacturer's catalogue for the switch shall contain information about the rating, category, and reference to relevant individual specification.

6.2 The push-button switches or their cartons may also be marked with the ISI Certification Mark.

Note — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

7. CONDITIONS FOR TESTS

7.1 Classification of Tests

7.1.1 Type Tests — The procedure for type approval shall be as recommended by IS : 2612-1965*. The minimum number of samples for type test shall be 20. The sequence of type test shall be as given in Appendix A.

7.1.2 Acceptance Test — The acceptance test shall be carried out on a limited number of samples which have passed the routine tests. The samples shall be selected in accordance with IS : 2612-1965*. Two groups of samples one for non-destructive tests (Group A) and the other for destructive tests (Group B) shall be selected and each group shall be subjected to the tests as given below in the sequence indicated.

<i>Group A (For Non-Destructive Tests)</i>	<i>Group B (For Destructive Tests)</i>
a) Operating Characteristics (7.5.9),	a) Dimensions (7.5.2),
b) Contact resistance (7.3.1),	b) Soldering (7.5.3),
c) Insulation resistance (7.3.3), and	c) Bump (7.5.6),
d) Voltage proof (high voltage) (7.3.4).	d) Robustness of terminations (7.5.4), and
	e) Climatic sequence (7.6.1).

7.1.3 Routine Test — The following shall be carried out on each and every switch:

- a) Visual examination (7.5.1), and
- b) Functional check (7.3.9).

7.2 General Conditions for Tests

7.2.1 General — The tests shall be carried out on the switches as received from the manufacturer or supplier. In no case shall the contact parts be cleaned or otherwise prepared prior to the tests unless explicitly so agreed.

7.2.2 Selection of Samples — The samples for testing shall be so selected as to be representative of each type, category and rating.

7.2.3 Atmospheric Conditions for Testing — Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions specified in IS : 589-1961†.

*Recommendation for type approval and sampling procedures for electronic components.

†Basic climatic and mechanical durability tests for electronic components (revised).

7.2.4 Preconditioning — Before measurements are made, the switches shall be stored at the measuring temperature for a time sufficient to allow the entire switch to reach that temperature. The recovery period called for after conditioning is adequate for this purpose.

7.2.5 Mounting — Where mounting is specified in a test, the switches shall be rigidly mounted on a metal plate using its normal fixing device, the dimensions of the mounting plate being such that the contour of the specimen under test is exceeded.

7.2.6 Correction to be Applied — When measurements are made at an ambient temperature other than the reference temperature, the results shall, where necessary, be corrected to that temperature. The ambient temperature during the test shall be stated in the test report.

7.2.7 Drying — Where drying is called for in this standard, the switches shall be conditioned, before measurement is made, for 96 ± 4 hours in a dry oven at a temperature of $55^\circ \pm 2^\circ\text{C}$. The switches shall then be allowed to cool in a desiccator using a suitable desiccant, such as activated alumina or silicagel and shall be kept therein from the time of removal from the oven to the beginning of the specified test.

7.2.8 Other Precautions — During measurement the switches shall not be exposed to draughts, direct sun rays or other influences likely to cause errors.

7.3 Electrical Tests

7.3.1 Contact Resistance

7.3.1.1 General measuring requirements — Measurement may be carried out with direct current or alternating current. The contact resistance shall normally be calculated from the potential difference measured between each pair of associated terminations. The contact shall be made before the measuring voltage is applied. In order to prevent the break-down of insulating film on the contact, the source emf shall not exceed 20 mV (dc or ac peak). In order to prevent undue heating of the contacts the current shall not exceed 1 ampere or the value specified by the relevant individual specification. For ac measurements the frequency shall be $1 \text{ kc/s} \pm 200 \text{ c/s}$. The measuring apparatus shall be such as to ensure an accuracy of at least ± 10 percent.

7.3.1.2 Measuring cycle: measurement with dc — One measuring cycle consists of:

- a) making the contact,
- b) connection of voltage source,
- c) measurement with current flowing in one direction,

- d) measurement with current flowing in the opposite direction,
- e) disconnection of voltage source, and
- f) breaking the contact.

7.3.1.3 Measurement with ac — One measuring cycle consists of:

- a) making the contact,
- b) connection of the voltage source,
- c) measurement,
- d) disconnection of voltage source, and
- e) breaking the contact.

7.3.1.4 Measurement — The contact resistance shall be measured between any two terminations that are to be connected by the switch. There shall be five measuring cycles. Measuring cycles shall be carried out in immediate succession.

7.3.1.5 Requirements — The value of the contact resistance for any individual measurement shall not exceed the value specified by the relevant individual specification.

Note — For low current contacts for use in the microvolt range, modifications of the measuring method or special requirements or both may be specified by the relevant individual specification.

When the test mentioned in the note above is required by the relevant individual specification the following details shall be specified:

- a) Maximum value of the current, if other than 1 ampere;
- b) Maximum value of the contact resistance; and
- c) Any deviation from the standard test method.

7.3.2 Variation of Contact Resistance

7.3.2.1 Method of measurement — The variation of contact resistance shall be determined during the vibration test. The measurement of the contact resistance shall be made throughout the whole of the test frequency sweep in each direction.

The variation of contact resistance shall be determined by means of a cathode-ray oscilloscope (with a long persistence screen) displaying the potential difference between the points intended for the connection of wiring to the contact when a direct current of 10 ± 2 mA is passed through the contact. The source emf shall not exceed 20 mV.

The measuring apparatus shall:

- a) have a frequency characteristic which is substantially flat between 400 c/s and 1 000 c/s with a decay below and above of not more than 3 dB at 70 c/s and 5000 c/s,

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- b) be such as to ensure a measuring accuracy better than ± 20 percent, and
- c) be calibrated with a sinusoidal voltage at 1 kc/s.

The number of contacts to be tested and the severity of the vibration test shall be specified by the relevant individual specification

7.3.2.2 Requirements— The values of the voltages produced by variation of switch resistance shall not exceed the value specified by the relevant individual specification.

When the test mentioned in 7.3.2 is required by the relevant individual specification, the following details shall be specified:

- a) Limit of the values of the voltage produced by variation of contact resistance,
- b) Severity of the vibration test,
- c) Number of contacts to be tested and number of measurement, and
- d) Any deviation from the standard test method.

7.3.3 Insulation Resistance— The insulation resistance shall be measured with a dc voltage of 100 ± 15 V or 500 ± 50 V as specified by the relevant individual specification. The switch shall be 'mounted' as specified in 7.2.5. The insulation resistance shall be measured after an electrification time of 1 minute ± 5 seconds.

NOTE— When appropriate, the reading may be taken after a shorter period.

The measurement shall be carried out for each switching position between:

- a) two adjacent terminations having minimum spacing, and
- b) all terminations connected together and all other exposed metal parts.

7.3.3.1 Requirement— The value of the insulation resistance shall be not less than the value specified by the relevant individual specification.

When the insulation resistance test is required by the relevant individual specification, the following details should be specified:

- a) Value of the test voltage,
- b) Minimum value of the insulation resistance, and
- c) Any deviation from the standard test method.

7.3.4 Voltage Proof (High Voltage)— Switches shall withstand without break-down or flash-over the voltage specified by the relevant individual specification. An ac test voltage shall be applied for one minute between the points indicated in 7.3.3.

The relation between the rated voltage U_R (rms value) and the test voltage E (rms value) is given as:

a) *For switches with rated voltage above 34 V (peak)*

$$E = 2 U_R + 1500 \text{ V with a minimum of } 2000 \text{ V}$$

b) *For switches with rated voltage below 34 V (peak)*

$$E = 500 \text{ V}$$

When this test is required by the relevant individual specification, the following details shall be specified:

- a) Value of the test voltage, and
- b) Deviation, if any, from the standard test method.

7.3.5 R. F. Shunt Resistance — The resistance shall be measured at a frequency of 1 Mc/s. The switch shall be mounted as specified in 7.2.5. For each basic cell, a measurement shall be carried out for each switching position between:

- a) two terminations whose contacts are open, and
- b) one termination and all other terminations which are connected to earth.

The R. F. shunt resistance shall be greater than 2 megohms.

7.3.6 Current Rating — Each switch contact shall be capable of carrying its rated current for a period of 5 hours without the rise in temperature at the terminations exceeding 20°C above the ambient temperature.

7.3.7 Overload — Each contact shall be capable of making or breaking a circuit carrying a current 50 percent greater than the rated current at a rated voltage 10 percent in excess of normal with a resistive load.

NOTE — This requirement applies unless otherwise specified in the relevant individual specification.

The test shall be applied 50 times at a rate of 5 operations per minute.

There shall be no external indication of mechanical damage, loosening of parts or extensive burning or pitting of the contacts.

7.3.8 Capacitance — The switch shall be mounted as specified in 7.2.5. The capacitance shall be measured between:

- a) individual terminations forming a part of a circuit but not in electrical contact, and
- b) individual terminations and all other terminations connected to the frame.

The connections shall not be soldered. The measuring frequency shall be 1 Mc/s \pm 10 percent.

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7.3.8.1 Requirements — The values of capacitance shall not exceed the values specified by the relevant individual specification.

When this test is required by the relevant individual specification, the following details shall be specified:

- a) The maximum values of the capacitances; and
- b) Deviation from the standard test method, if any.

7.3.9 Functional Check — The switches shall be connected to circuits of test lamp or other indicating device and subjected to one or more cycles of operation as specified in the relevant specification.

The switch shall be actuated by an even motion. The operation shall be satisfactory and shall exhibit no discontinuity or intermittent operation. There shall be no intermediate hold up of the mechanism, nor undue wobbling of the push buttons. In case of interlocked buttons, if all such buttons can be pressed-in and locked simultaneously, it shall be possible to release the buttons by pressing a button.

7.4 Illumination Test

7.4.1 Chromaticity — This test is applicable only if called for in the detailed specification.

The colour of a light signal is measured in terms of its chromaticity co-ordinates using the trichromatic system recommended by the International Commission on Illumination in 1931. The colour is expressed in the chromaticity co-ordinates X, Y and Z; the sum of which is unity.

The co-ordinate X is analogous to the proportion of red, Y to the proportion of green, and Z to the proportion of blue.

7.4.1.1 Measurement — The light signal shall be operated under the conditions stipulated by the manufacturer and, if the light source can be colour-matched by a full radiator, its colour temperature shall be stated by the manufacturer. The colour of the light signal shall be defined by the chromaticity of the light reflected at an angle of 45 degrees from a magnesium oxide screen which is placed normal to the optical axis of the light signal at a distance sufficient to ensure that the apparent colour of the screen is uniform. Measurements shall be carried out at a temperature of 20°C, unless otherwise specified, using any of the methods defined in 7.4.3.2.

7.4.1.2 Summary — When this test is required by the relevant sheet, the following details shall be specified:

- a) Limits of the chromaticity co-ordinates,

- b) The luminous intensity of the light emitted per unit projected surface area,
- c) Colour temperature of the light source, and
- d) Any deviation from the standard test method.

7.4.2 Illuminated Surface Temperature — The surface temperature of a button shall be measured after a period of illumination of one hour. The axes of the button travel of the switch, mounted as given in 7.2.5 shall be in the vertical plane, with the internal lamp to be below the surface of the button.

7.4.2.1 Requirements — The temperature-rise shall not exceed the maximum value specified by the relevant sheet.

7.4.2.2 Summary — When this test is required by the relevant sheet, the following details shall be specified:

- a) The maximum temperature-rise, and
- b) Any deviation from the standard test method.

7.4.3 Transmittancy — The transmittancy of a colour filter is expressed as the percentage ratio of the luminance of a truly white screen, illuminated from a light source, to the luminance of the same screen when the colour filter is replaced by a non-absorbing medium of the same pattern and refractive index.

7.4.3.1 Measurement — The tests shall be carried by using any of the methods given in 7.4.3.2.

7.4.3.2 Methods of measurement — Measurements may be made with a colorimeter by spectrophotometric analysis, by comparison with calibrated colour filters or by any method which gives the results in terms of the system recommended by the International Commission on Illumination in 1931.

7.5 Mechanical Tests

7.5.1 Visual Examination — The marking shall be in accordance with 6. The workmanship and finish shall be satisfactory.

There shall be no visible deterioration after electrical, mechanical and climatic tests. The switch shall be mechanically operable and there shall be no displacement or loosening of contacts.

7.5.2 Dimensions — The dimensions of the switch shall be checked and shall be in accordance with those specified in the relevant individual specification for the type under test.

7.5.3 Soldering — In order to determine the ability of the terminations to wet easily and to check that the switch itself will not be damaged by soldering processes, the switch shall be tested in accordance with 7.18 of IS : 589-1961*.

After the test, there shall be no sign of mechanical damage or loosening of parts and the switch shall still be mechanically operable.

When this test is required by the relevant individual specification, the following details shall be specified:

- a) Method of test, including size of the soldering iron where applicable;
- b) Period of recovery; and
- c) Deviation, if any, from the standard test method.

7.5.4 Robustness of Terminations

7.5.4.1 Tensile test — This test shall be carried out in accordance with 7.19.1 of IS : 589-1961*. The loading weight shall be as specified in the relevant specification.

7.5.4.2 Bend test — This test shall be carried out in accordance with 7.19.2 of IS : 589-1961*. For tag terminations two consecutive bends shall be applied in accordance with 7.19.2.3 of IS : 589-1961*.

7.5.4.3 Torsion test on screw terminals — This test shall be carried out in accordance with 7.19.4 of IS : 589-1961*.

After each of the test, the switch shall be visually examined. There shall be no sign of mechanical damage or loosening of parts and the switch shall still be mechanically operable.

When the test for Robustness of terminations is required by the relevant individual specification, the following details shall be specified:

- a) Tests to be carried out;
- b) Test conditions, such as value of the forces; and
- c) Deviation from the standard test method, if any.

7.5.5 Vibration — This test shall be carried out in accordance with 7.6 of IS : 589-1961* using the appropriate degree of severity. There shall be no measurements prior to the test, those which have been carried out during final measurements of the proceeding tests shall be regarded as the initial measurement of the vibration test. The

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switch shall be mounted as specified in 7.2.5. The following tests shall then be carried out:

- a) the verification of opening of the contacts. The break of contacts means a break in excess of 10 μ s.
- b) if specified, the variation of contact resistance.

There shall be no intermittancy of current greater than those specified in the relevant individual specification.

NOTE — A continuous monitoring circuit is under consideration.

The switches shall then be visually inspected and they shall show no sign of deterioration.

When this test is required by the relevant individual specification the following details shall be specified:

- a) Severity of test,
- b) Requirements for the variation of contact resistance,
- c) Final measurements, and
- d) Any deviation from the standard test method.

7.5.6 Bump — The switch shall be mounted on the table of a bump test machine and connected in a circuit with a suitable device, such as a lamp which will indicate momentary spurious operations during the test.

NOTE — A continuous monitoring circuit is under consideration.

7.5.6.1 The switches shall be subjected to the bump test in accordance with 7.5.1 of IS : 589-1961*.

7.5.6.2 There shall be no spurious operation, no fracture or loosening of parts, or other mechanical failure. The fixing shall not become loose.

When this test is required by the individual specification the following details shall be specified:

- a) Number of bumps, and
- b) Any deviation from the standard test method.

7.5.6.3 The contact resistance shall be measured as in 7.3.1 after the test and the values shall not exceed the limits specified in the relevant individual specification.

7.5.7 Acceleration — The switches shall be mounted in the normal manner on a table of acceleration test machine. During the test the electrical continuity shall be continuously monitored. There shall be no

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intermittency electrical continuity of duration greater than that specified in the relevant individual specification.

7.5.7.1 The switches shall be subjected to the acceleration test in accordance with 7.7 of IS 589-1961*. The severities of acceleration shall be as specified in the relevant specification.

7.5.7.2 The duration of the acceleration test in each case shall be of 8 minutes.

7.5.7.3 During the acceleration test, there shall be no spurious operation. After the acceleration test, the switches shall be visually examined and there shall be no fracture or loosening of parts or any other mechanical failure. The fixing shall not become loose.

7.5.7.4 The contact resistance shall then be measured and the value of the contact resistance shall not exceed the limit specified in the relevant specification.

7.5.8 Shock— The component shall be mounted on the moving table of shock test apparatus in its three principal axes in turn and subjected to the shock test in accordance with 7.5.2 of IS: 589-1961*.

7.5.8.1 During the test, electrical continuity shall be continuously monitored. There shall be no intermittency of electrical continuity of duration greater than that specified in the relevant individual specification (This is not applicable for category 3 components.)

7.5.8.2 During the shock test, there shall be no spurious operation. After the shock test, the components shall be visually examined and there shall be no fracture or loosening of parts or other mechanical failure. The fixing shall not become loose.

7.5.8.3 The contact resistance shall be measured and the value shall not exceed the limits specified in the relevant specification.

7.5.9 Operating Characteristics—The following items shall be tested according to the relevant individual specification:

- a) Button travel to release a previously operated button,
- b) Button travel to operate its own lamp circuitry,
- c) Button travel to operate its own contacts,
- d) Force on a double pressure button to achieve locking action,

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- e) Force on a button to release a previously operated button, and
- f) Maximum force on a button for which it will not come off its fixing.

7.6 Climatic Tests

7.6.0 General — Where applicable, the switch shall be mounted as specified in 7.2.5. In each test, the final measurements stated shall be carried out in the order stated.

7.6.1 Climatic Sequence

7.6.1.1 Dry heat — This test shall be carried out in accordance with 7.1 of IS : 589-1961*, using the appropriate degree of severity.

While still at the high temperature, the insulation resistance shall be measured and shall be not less than the values specified by the relevant individual specification.

In addition, while the switches are at the high temperature, there shall be a check that the switch is mechanically operable.

The switches shall then be removed from the chamber and exposed to the standard recovery conditions appropriate to the test.

7.6.1.2 Damp heat accelerated (first cycle) — The switches shall be subjected to the first cycle of this test in accordance with 7.4 of IS : 589-1961*. After the specified period of conditioning, the switches shall be removed from the chamber and allowed to remain under standard recovery conditions appropriate to the test.

After recovery, the switches shall be visually examined. There shall be no corrosion or mechanical deterioration or any other visible damage. The marking shall be legible.

7.6.1.3 Cold — This test shall be carried out in accordance with 7.1 of IS : 589-1961*, using the appropriate degree of severity. While still at the low temperature, there shall be a check that the switch is mechanically operable. The switches shall then be removed from the chamber and exposed to the standard recovery conditions appropriate to this test.

The switches shall then be visually examined and they shall show no sign of deterioration.

7.6.1.4 Low air pressure — This test shall be carried out in accordance with 7.12 of IS : 589-1961*, using the appropriate degree of severity.

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The test chamber shall be maintained at a temperature of 15° to 35°C
The duration of the test shall be five minutes.

During the test, a voltage shall be applied between:

- a) two adjacent terminations having minimum spacing, and
- b) all terminations connected together and the mounting frame.

The value of the test voltage shall be specified by the relevant individual specification.

During and after this test, there shall be no signs of glow discharge, breakdown, flashover or harmful deformation of the device.

7.6.1.5 Damp heat accelerated (remaining cycles) - The switches shall be subjected to the remaining number of cycles of this test in accordance with 7.4 of IS : 589-1961*.

Note — Remaining damp heat cycles required are as follows:

Category 1	:	5 cycles
Category 2	:	5 cycles
Category 3	:	1 cycle

The switches shall then be removed from the chamber and exposed to the standard recovery conditions appropriate to this test.

7.6.1.6 Final measurements — The switches shall then be subjected to the following tests and shall meet the requirements specified by the relevant individual specification:

- a) Insulation resistance (7.3.3),
- b) Voltage proof (high voltage) (7.3.4),
- c) Contact resistance (7.3.1),
- d) Functional check (7.3.9), and
- e) Visual examination (7.5.1).

Note — The first two tests shall be carried out immediately following the recovery period and in the contact position in which the devices are removed from the chamber. Insulation resistance and voltage proof (high voltage) may be checked in other positions after the contact resistance has been measured.

7.6.2 Damp Heat (Long Term Exposure) — This test shall be carried out in accordance with 7.3 of IS : 589-1961*. Specimens shall be divided into three lots and a polarizing voltage shall be applied to specimens in two of the lots as follows:

Lot 1 : non-polarized.

Lot 2 : two adjacent terminations having minimum spacing.

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Lot 3 : all terminations connected together and to all other metal parts. The positive potential shall be applied to the terminations.

The value of the polarizing voltage shall be 15 V dc unless otherwise specified.

The switches shall then be removed from the chamber and exposed to the standard recovery conditions appropriate to this test.

7.6.2.1 Final measurement — The switches shall then be subjected to the following tests and shall meet the requirements specified by the relevant individual specification:

- a) Insulation resistance (7.3.3),
- b) Voltage proof (high voltage) (7.3.4),
- c) Contact resistance (7.3.1),
- d) Functional check (7.3.9), and
- e) Visual examination (7.5.1).

NOTE — The first two tests shall be carried out immediately following the recovery period and in the contact position in which the switches are removed from the chamber, insulation resistance and voltage proof may also be checked in other contact positions after the contact resistance has been measured.

When this test is required by the relevant individual specification, following details shall be specified:

- a) Value of the polarizing voltage if other than 15 V dc;
- b) Requirements for the final measurements; and
- c) Deviation, if any, from the standard method.

7.6.3 Rapid Change of Temperature — This test shall be carried out in accordance with 7.14 of IS : 589-1961*. The total number of cycles shall be five. The switches shall then be removed from the chamber and exposed to the standard recovery conditions appropriate to this test.

7.6.3.1 Final measurement — The switches shall then be subjected to the following tests and shall meet the requirements specified by the relevant individual specification:

- a) Insulation resistance (7.3.3),
- b) Voltage proof (high voltage) (7.3.4), and
- c) Visual examination (7.5.1).

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When this test is required by the relevant individual specification, the following details shall be specified:

- a) Requirements for the final measurement, and
- b) Any deviation from the standard test method.

7.6.4. Sealing (Where Applicable) — This test shall be carried out in accordance with 7.15 of IS : 589-1961*. When this test is required by the relevant individual specification it shall specify all details for the test procedures together with the requirements.

7.6.5 Mould Growth — The switches shall be subjected to mould growth test in accordance with 7.9 of IS : 589-1961*.

After the expiry of the specified period of exposure, there shall be no mould growth on the switches visible to the naked eye.

7.6.6 Salt Mist — The switches shall be subjected to salt mist test in accordance with 7.10 of IS : 589-1961*, the period of exposure being four days.

After the expiry of the test, the switches shall be removed from the chamber and visually examined, for any deterioration, such as corrosion, damage and legibility of marking.

7.6.7 Dust — Under consideration.

7.7 Endurance Tests

7.7.1 The switches shall be operated mechanically to make and break the main contacts a number of times as specified in the relevant individual specification. If the electrical ratings of the main contacts cover more than one combination of voltage and current, the test shall be carried out with the rated current and the associated voltage. A cycle of operation shall be as follows:

The movement of a button from its ' off position ' (normal position) to the ' on position ' (operated position), and return to its ' off position ' (see 2.5.3 and 2.5.4).

Double pressure locking buttons shall have the second pressure applied as being part of a cycle of operation.

Where the speed of the button travel is critical, it shall be specified in the detail specification.

The number of cycles of operation per minute shall be between 10 and 15.

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7.7.2 Test at Normal Air Pressure — The following tests shall be carried out on separate switches 15 000 cycles being performed in each case. Each button shall be operated in turn to complete the cycle. For category 1 and 2 switches the test shall be carried out at maximum category temperature:

a) *Inductive circuit*

- 1) The test shall be carried out using an inductive circuit with the dc voltage and current as specified in the relevant individual specification.
- 2) The circuit used for this test shall have a time constant between 2 and 3 ms.
- 3) The duty cycle shall be approximately 25 percent 'on' and 75 percent 'off'.

b) *Lamp load*

- 1) The test shall be carried out using a lamp load with the voltage and current as specified in the relevant individual specification.
- 2) For switches having a dc or dc/ac rating, the test shall be carried out with dc.
- 3) For switches having an ac rating only, the test shall be carried out with ac.
- 4) Only tungsten lamps each of which having a nominal power not exceeding 25-W at the voltage specified by the relevant individual specification shall be used for the load.
- 5) For independent buttons the duty cycle shall be approximately 25 percent 'on' and 75 percent 'off'.

c) *Resistive circuit*

- 1) The test shall be carried out using a resistive circuit with the ac voltage and the current as specified in the relevant individual specification.
- 2) For independent buttons the duty cycle shall be approximately 50 percent 'on' and 50 percent 'off'.

d) *Final measurement* — The switches shall then be subjected to the following tests and shall meet the requirements specified by the relevant individual specification:

- 1) Insulation resistance (7.3.3),
- 2) Voltage proof (high voltage) (7.3.4),
- 3) Contact resistance (7.3.1),

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- 4) **Functional check (7.3.9), and**
- 5) **Visual examination (7.5.1).**

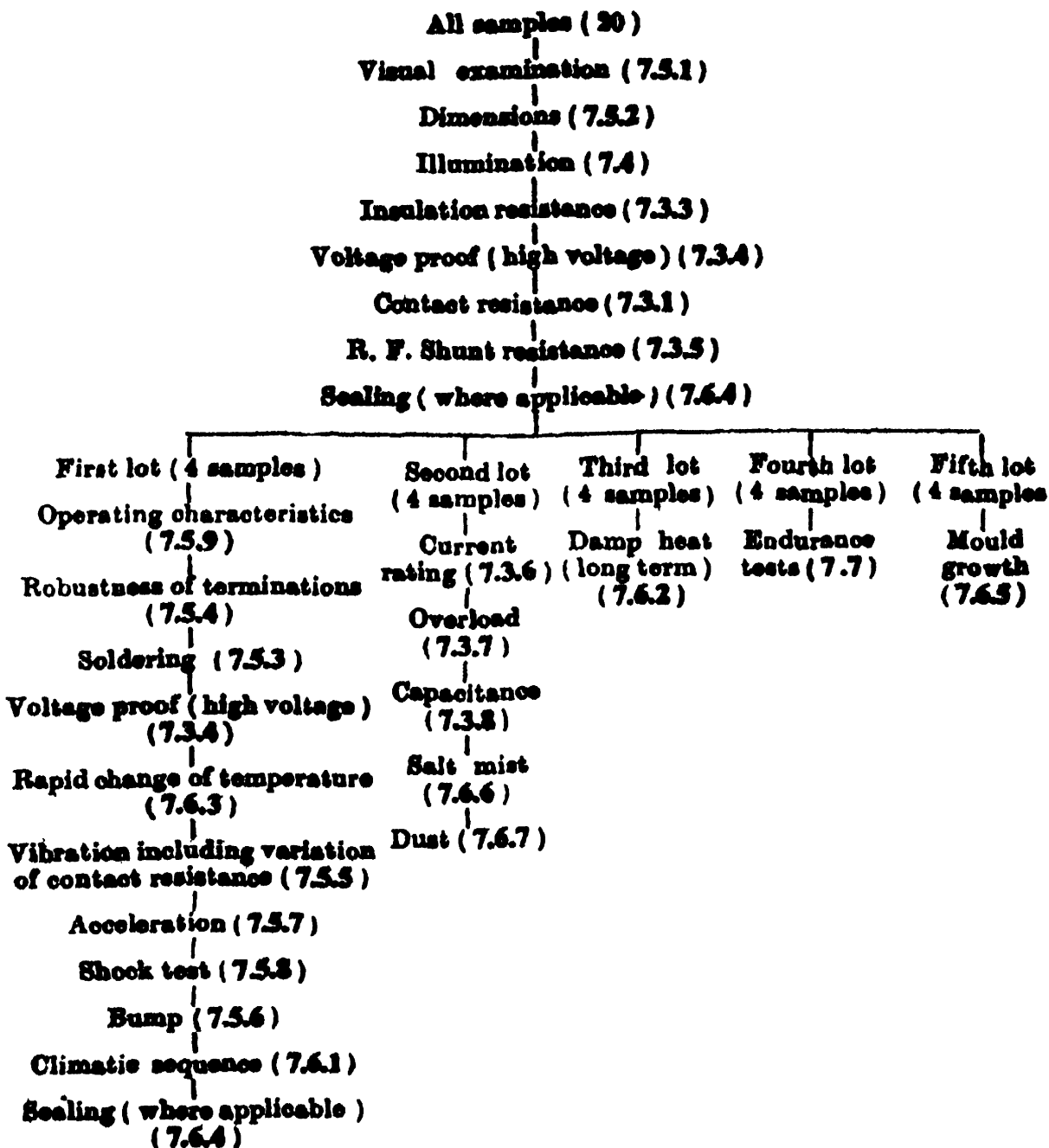
When this test is required by the relevant individual specification, the following details shall be specified:

- a) **Values of test voltages and currents,**
- b) **Requirements for the final measurement, and**
- c) **Any deviation from the standard test method.**

APPENDIX A

(Clause 7.1.1)

SEQUENCE OF TYPE TESTS



INDIAN STANDARDS

ON

Electromechanical Components

IS:		Rs
1885 (Part VI)-1965	Electrotechnical vocabulary: Part VI Printed circuits	1.50
2612-1965	Recommendation for type approval and sampling procedures for electronic components	3.50
2628 (Part I)-1964	Rotary wafer switches (low current rating): Part I Tests and general requirements	4.50
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2925-1964	Dimensions of connectors for radio batteries ...	2.00
3354 (Part I)-1965	Valve sockets: Part I General requirements and tests	5.00
3354 (Part II)-1965	Valve sockets: Part II Dimensions and construction of gauges and tools	2.50
3354 (Part III)-1967	Valve socket: Part III Valve sockets for octal base	3.50
3354 (Part IV)-1967	Valve socket: Part IV Valve sockets for 9-pin miniature base	5.00
3452 (Part I)-1966	Specification for toggle switches: Part I General requirements and tests	4.50
3544-1966	General requirements and tests for tag strips ...	3.00
3720-1966	Dimensions of polarized plugs for hearing aids ...	1.00
3826 (Part I)-1966	Connectors used for frequencies below 3 Mc/s: Part I General requirements and tests	6.00
4007 (Part I)-1967	Terminals for electronic equipment: Part I General requirements and tests	5.50
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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices:

	Telephones
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI-110002	[331 01 31 331 13 75
*Eastern : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Maniktola, CALCUTTA 700054	36 24 99
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	[2 18 43 3 16 41
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Branch Offices:

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*Sales Office in Calcutta is at 5 Chowringhee Approach, P.O. Princep Street, Calcutta 700072 27 68 00

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